

# Common Refractive Surgery Complications: Manage or Refer?

# Complications: Manage or Refer?

## ➤ Early

- Pain
- Sterile Infiltrates
- Infectious Keratitis
- Epithelial sloughing
- Delayed Epithelialization

## ➤ Early or Late

- Ocular Hypertension
- Ptosis
- Halos
- Central Islands
- Decentration
- Recurrent Corneal Erosion
- Dry Eye
- Haze
- Loss of BCVA
- Regression

# Complications: Manage or Refer?

## ➤ Pain

- Intensity variable
  - FBS, “sand,” “eyelash”
  - “Broken contact lens”
  - “Knives, rocks, bricks”
  - Ache
- Related to epithelial defect
- Lasts 24-48-72 hours
- May re-intensify the last 12 hours

## ➤ Treatment

- Reassurance – “Normal”
- Topical Tetracaine
- Chilled Celluvisc
- Bandage SCL
- Oral pain medication
- Cool compresses, “frozen peas”

# Complications: Manage or Refer?

## ➤ Sterile Infiltrates

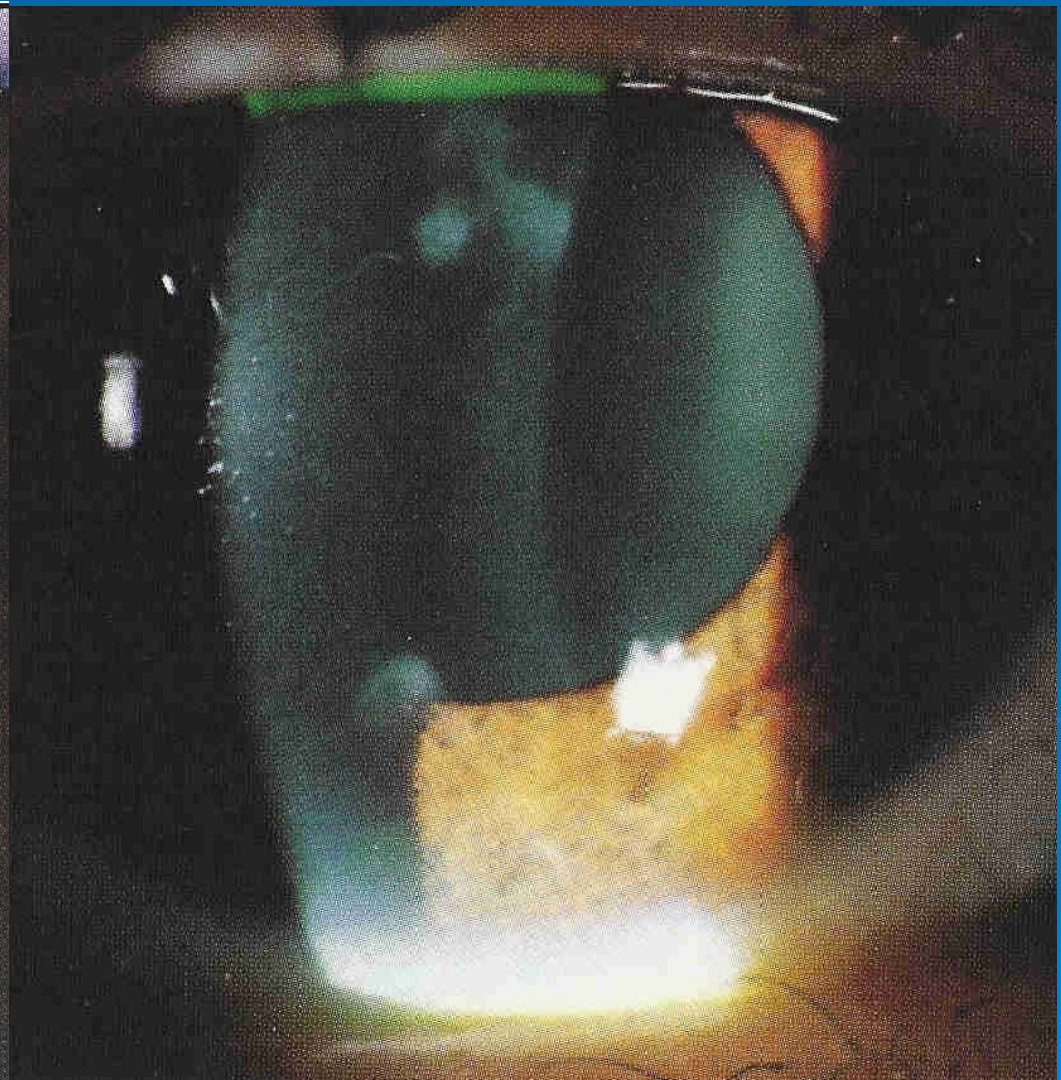
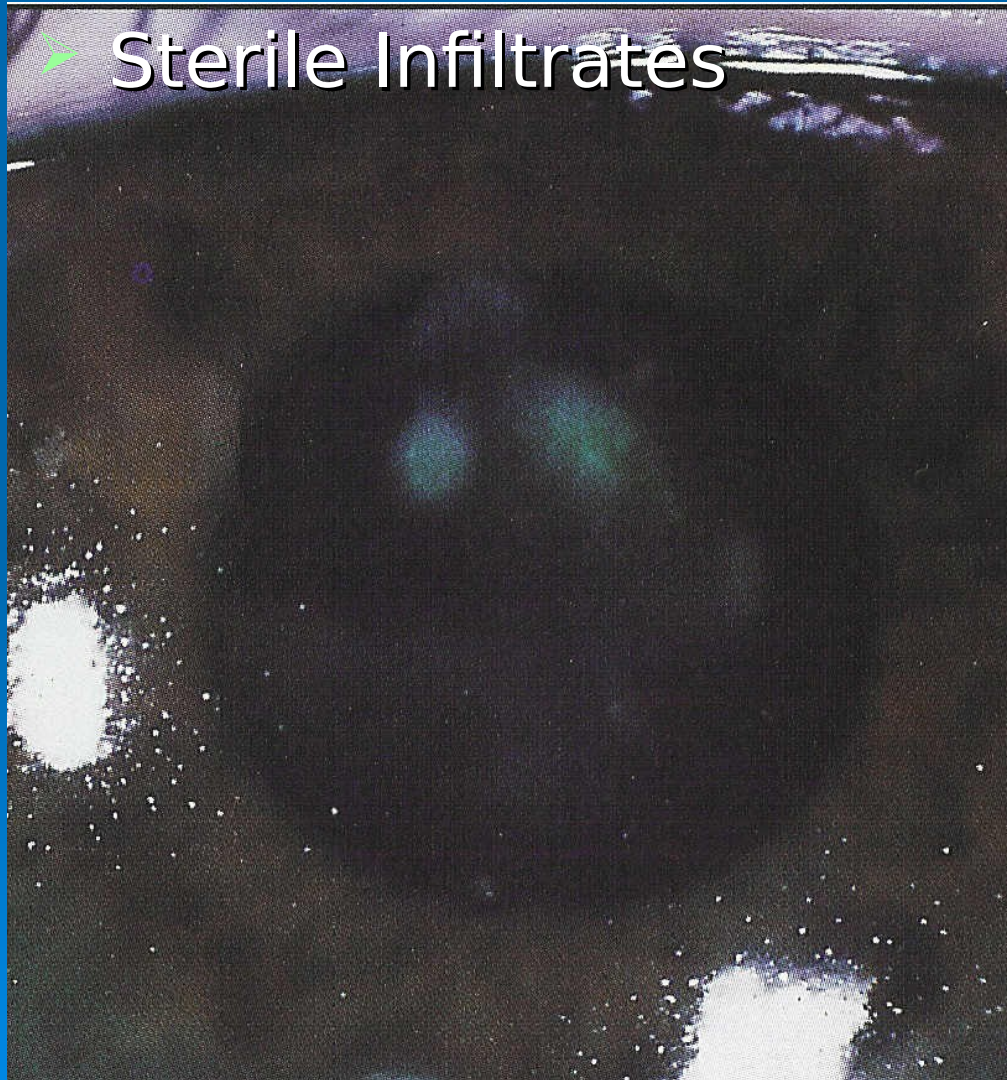
- Infrequent, <1:300
- Focal opacities, <1.0 mm
- Well-defined margins
- Epithelium intact
- Usually multiple, round/oval
- Peripheral, upper lids
- (May be CL related, hypoxia)
- Watch for true infectious keratitis

## ➤ Treatment

- Start/change/increase steroids
- Antibiotic coverage
- (Remove BCL)
- Very low threshold to culture
- Monitor closely, q24h



# Complications: Manage or Refer?



# Complications: Manage or Refer?

## ➤ Infectious Keratitis

- Infrequent, <1:1000
- Corneal infiltrate, 0.5-2.0 mm
- Less defined
- Overlying epithelial defect
- Usually unifocal but can be multiple
- Often within the ablation zone

## ➤ Treatment

- Culture
- Some recommend topical ofloxacin or ciprofloxacin qh if small lesion
- Tobradex/Blephamide
- 4th gen fluoroquinolones
- Consider fortified antibiotics qh
- Consider cycloplegia



# Complications: Manage or Refer?

## ➤ Delayed Epithelialization (>4days)

- Low Frequency
- Associated with
  - Early TSCL removal
  - Poor/tight TSCL fit
  - Debris under TSCL
  - Epithelial flap
  - Patient predisposition (ocular surface or systemic)

## ➤ Treatment

- Add or exchange TSCL
- Increase lubrication
- Continue antibiotic
- Punctal occlusion
- Consider topical anesthetic abuse, HSV, infectious keratitis

# Complications: Manage or Refer?

- Ptosis – seldom seen
  - Young females
  - Related to steroid frequency and potency
  - 1-2 mm lag
  - Diurnal variation associated with dosing
  - Post-op lid edema and speculum used

- Treatment
  - Improves with time
  - Resolves when d/c steroids
  - Change frequency, potency, and duration once evident



# Complications: Manage or Refer?

## ➤ Ocular Hypertension

- Ta > 25, 8mm rise
- Topical steroid-related
- 30% population steroid responsive
- IOP monitoring essential (monthly)

## ➤ Treatment

- Xalatan (Latanaprost)
- Timolol (Timoptic)
- Brimonidine (Alphagan)
- Dorzolamide (Trusopt)
- Acetazolamide (Diamox)

- Do not independently stop steroids

# Complications: Manage or Refer?

## ➤ Ablation Related

- Haloes
- Central Islands
- Decentration



# Complications: Manage or Refer?

## ➤ Halos

- Common early
- Uncommon late

## ➤ Causes

- Epithelial abnormalities
- Residual refractive error
- Large pupil
- Central islands
- Decentered ablation
- Astigmatic ablations

## ➤ Treatment

- Depends on cause
- Improves or resolves in most patients with time
- Persistent symptoms – spectacle Rx night driving
- If pupil related consider
  - Dapiprazole
  - Pilocarpine (careful)

# Complications: Manage or Refer?

## ➤ Central Islands

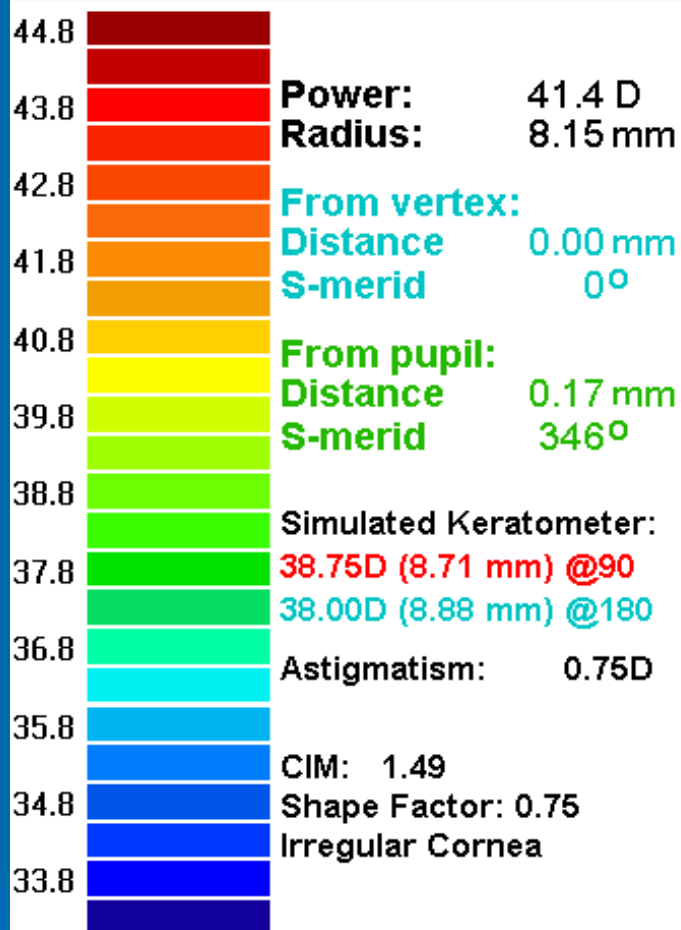
- Central elevation on topography
- No uniform definition, usually 1-3 D in height, 1-3 mm diameter, 1 month PO visit
- Uncommon
- Symptoms of monocular diplopia, ghosting, qualitative vision issues

## ➤ Causes

- Fluid wave
- Plume obstruction
- Laser optics
- Epithelial hyperplasia
- Other, multi-factorial
- New gen lasers - rarity

## ➤ Treatment

- Most resolve in time
- PTK



Diopeters

Standard

AutoSize

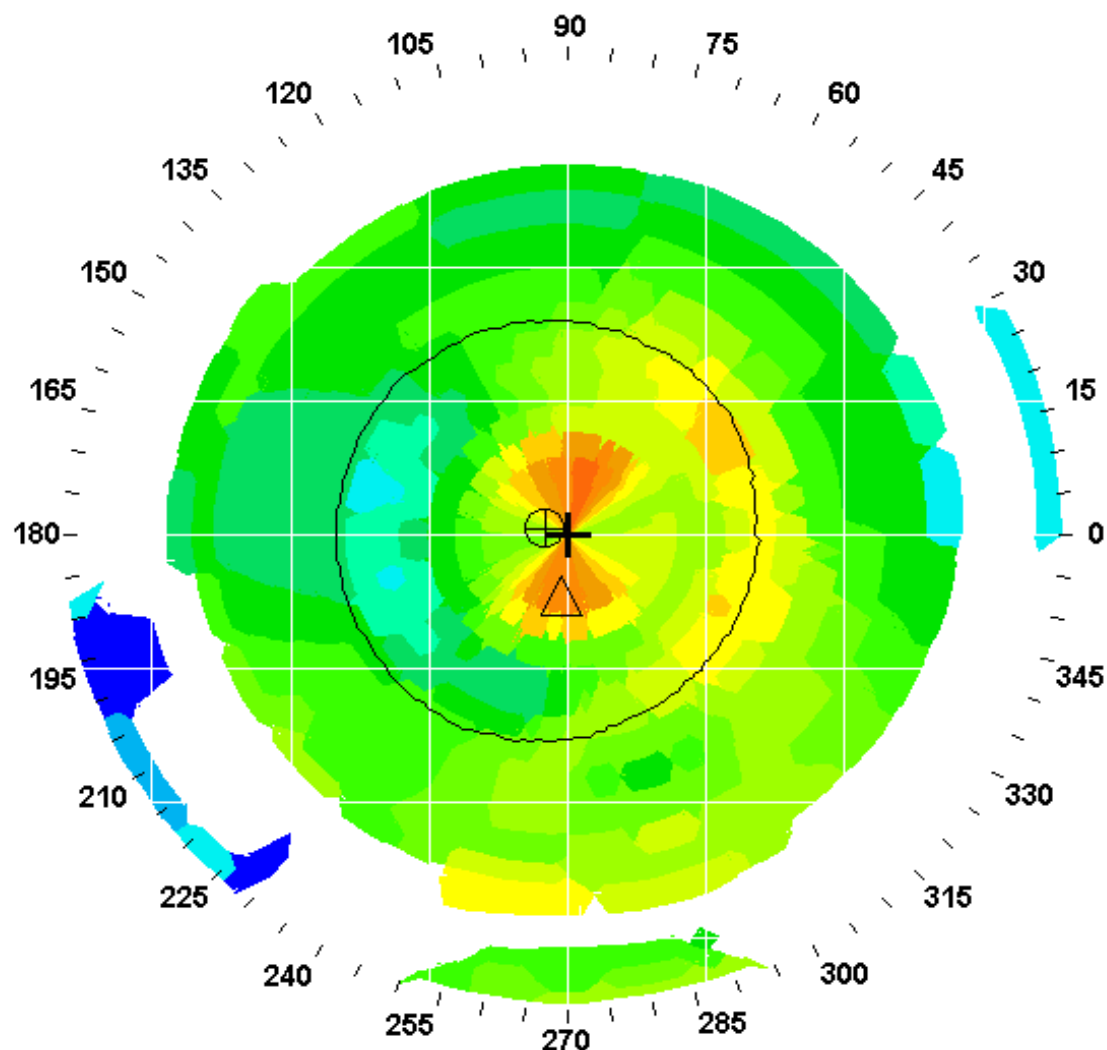
Custom

Options

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# Complications: Manage or Refer?

## ➤ Decentered Ablation

- Decentration of  $> 1\text{mm}$  by topography at 1 month
- Asymmetric healing can make centered ablation appear decentered
- Loss of BCVA, glare, halos, diplopia, etc..

## ➤ Causes

- Laser misalignment
- Poor patient fixation
- Surgical decentration
- Movement / misalignment during topography
- Effective “eye trackers” all but eliminate this today

# Complications: Manage or Refer?

## ➤ Decentered Ablation cont'd.

- Treatment
  - Occlusive masks
  - Retreatment with equal and opposite decentration
  - Others/None ideal
- Await future technology
  - Custom ablations
  - Topography linked ablations
  - Wave front ablations??

# Complications: Manage or Refer?

## ➤ Recurrent Corneal Erosion

- Pain, FBS, tearing
- Decreased vision
- Usually upon awakening
- Epithelial defect or microcysts
- Rare after PRK
- Likely due to underlying predisposition and outside ablation zone

## ➤ Treatment

- Antibiotics until epithelialized
- Lubricants
- BCL
- Hypertonic saline/ung.
- PTK / PRK
- Stromal puncture

# Complications: Manage or Refer?

## ➤ Subjective Dry Eyes

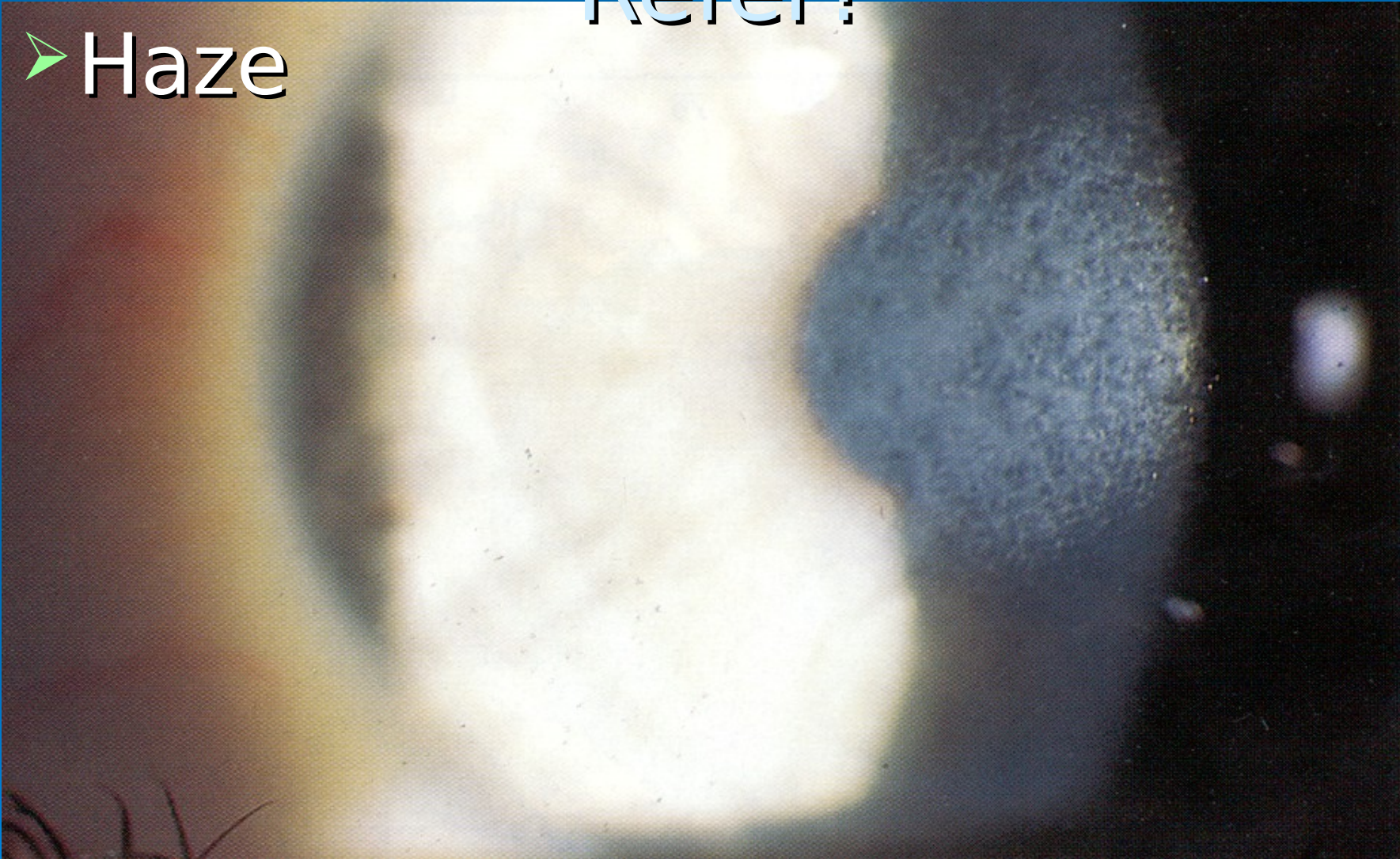
- Common early
- Uncommon late

## ➤ Treatment

- Lubricants
- Punctal occlusion
- Manage blepharitis

# Complications: Manage or Refer?

## ➤ Haze





# Complications: Manage or Refer?

## ➤ Haze

- Early onset occurs in first 3-6 months, then resolves
- Late onset occurs 4-33 months post-op
- Most asymptomatic
- Can have loss of BCVA, visual symptoms
- Central haze may be associated with regression
- Peripheral haze may be associated with astigmatism or over-correction

# Complications: Manage or Refer?

## ➤ Haze

- Potential causes

- UVB exposure
- Deeper/steeper ablations
- Laser beam homogeneity
- Epithelial removal technique
- K sicca
- Keloid formation (?)
- Rapid steroid taper (?)

- Prevention

- Patient selection
- Sx: Cold BSS irrigation
- Sunglasses

# Complications: Manage or Refer?

## ➤ Haze Grading

- 0: clear cornea
- Trace: barely perceptible haze apparent only to trained observer
- 1.0: mild reticular haze not affecting refraction
- 2.0: moderate haze, refraction possible but difficult
- 3.0: opacity prevents refraction, anterior chamber easily viewed
- 4.0: opacity impairs view of anterior chamber and iris detail
- 5.0: totally opaque scar, anterior chamber not visible

McDonald *et al.*, *Ophthalmology* 1991;98:1327

# Complications: Manage or Refer?

## ➤ Haze Grading

- 0: clear, no haze
- 0.5: haze, barely detectable
- 1.0: mild, not affecting refraction
- 1.5: haze mildly affecting refraction
- 2.0: moderate haze, refraction possible but difficult
- 3.0: opacity prevents refraction, anterior chamber easily viewed
- 4.0: opacity impairs view of anterior chamber
- 5.0: unable to see anterior chamber

Braunstein *et al.*, *Ophthalmology* 1996;103:439

# Complications: Manage or Refer?

## ➤ Haze Grading

- Trace: trace of faint haze by indirect broad oblique illumination
- Mild: discrete haze visible with difficulty by direct focal slit examination. More granular and confluent than trace.
- Moderate: moderately dense corneal opacity that obscures iris detail in direct illumination
- Severe: a severely dense opacity that completely obscures iris detail

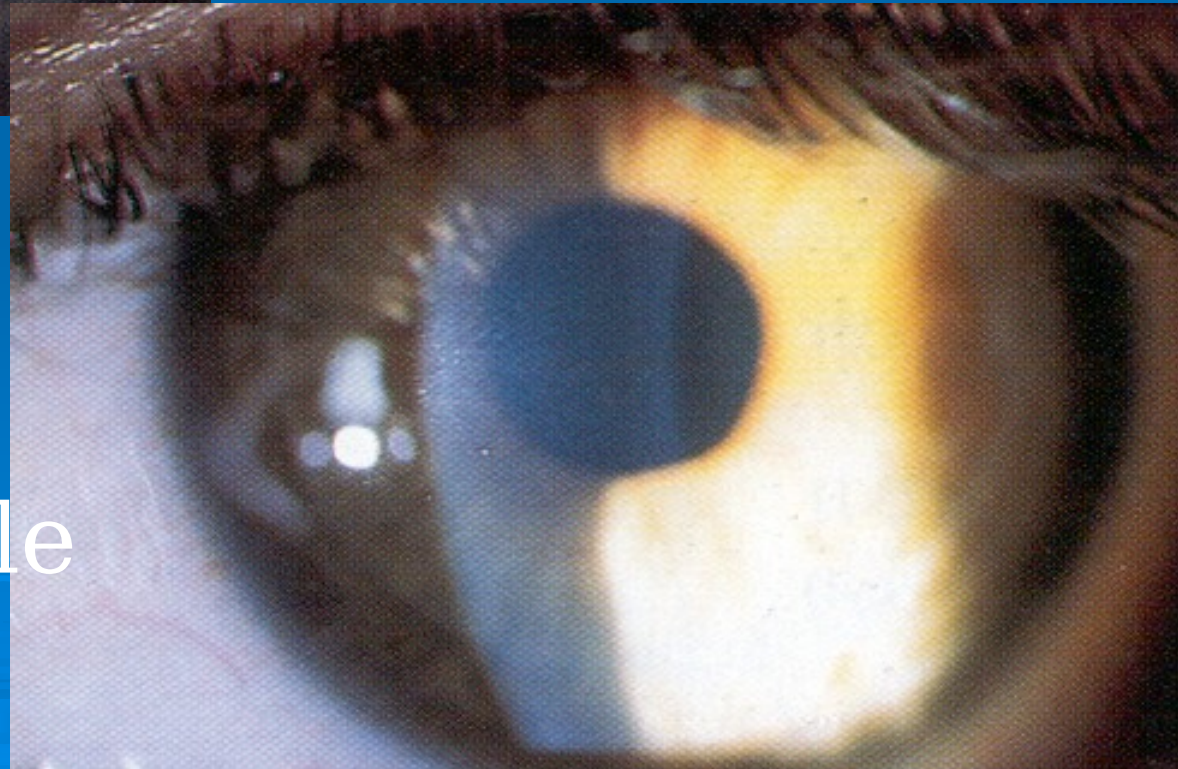
Stein, The Excimer: Fundamentals and Clinical Use,  
SLACK, 1997





Haze 0.5+

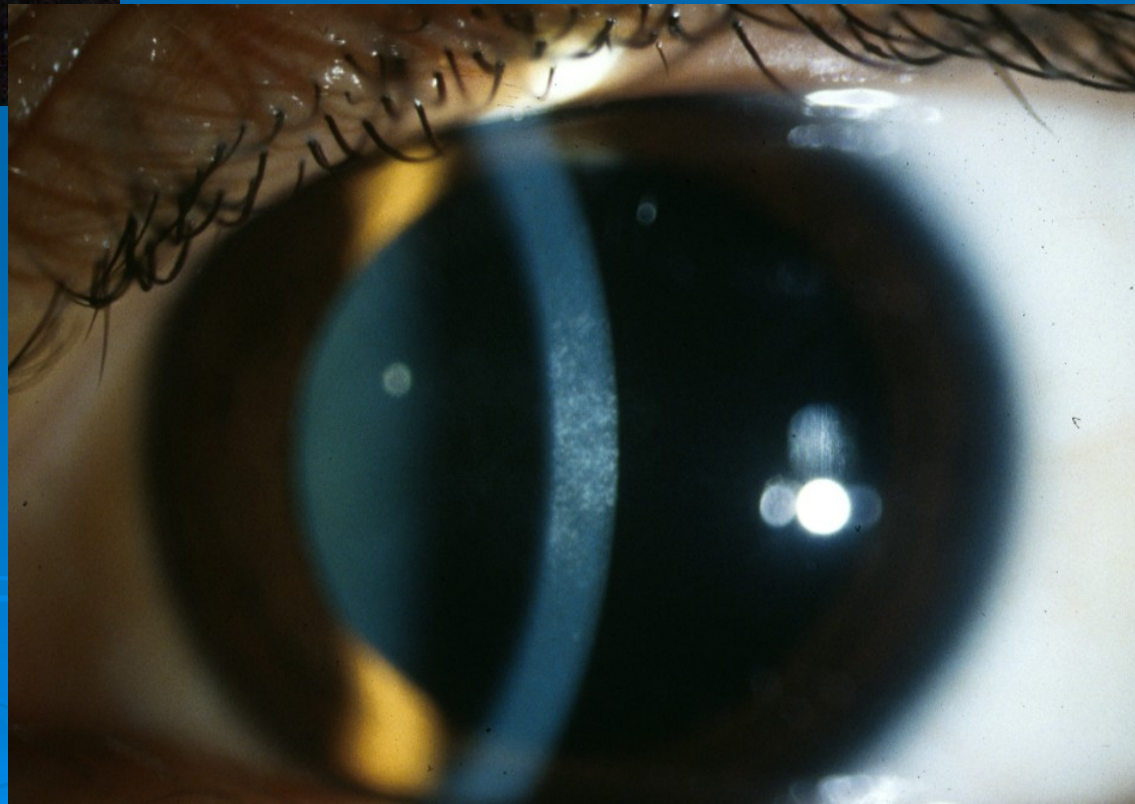
Trace, 0.5+  
Fine reticular  
Barely perceptible





Haze 1.0+

Mild 1.0+  
Reticular haze  
Easily visible





# Haze 2.0+

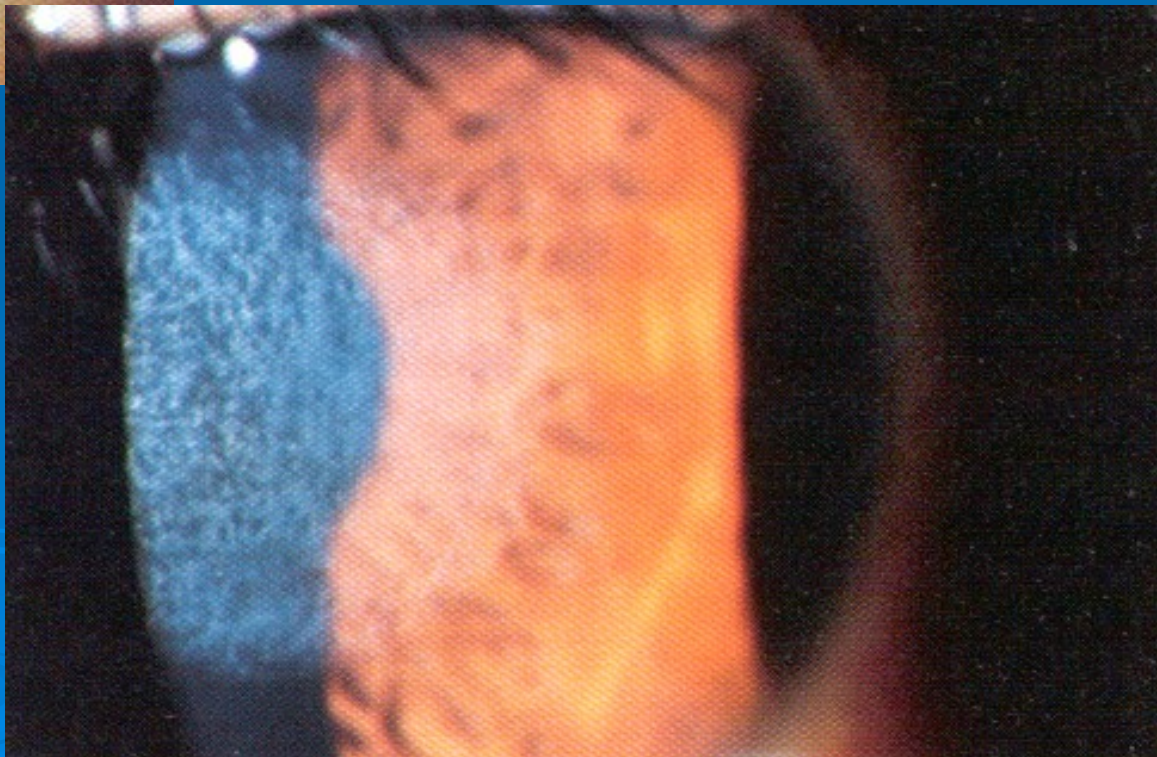


Moderate, 2.0+  
Focal pattern  
Confluence



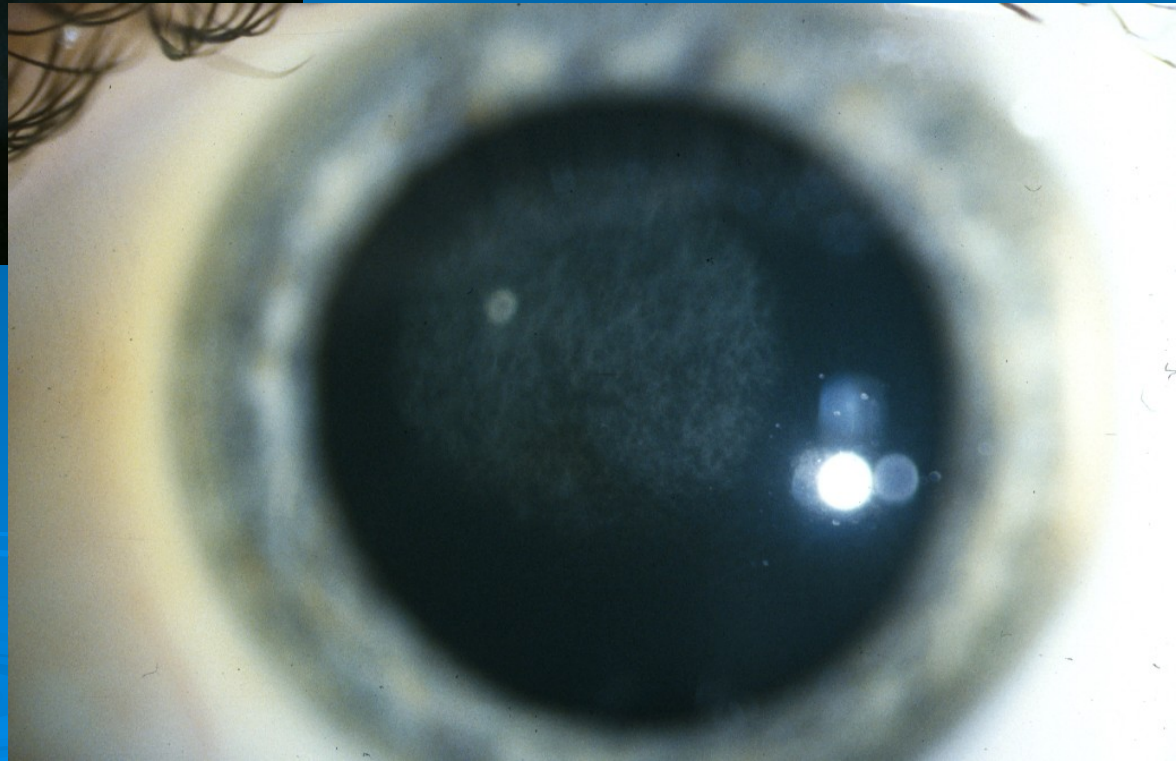
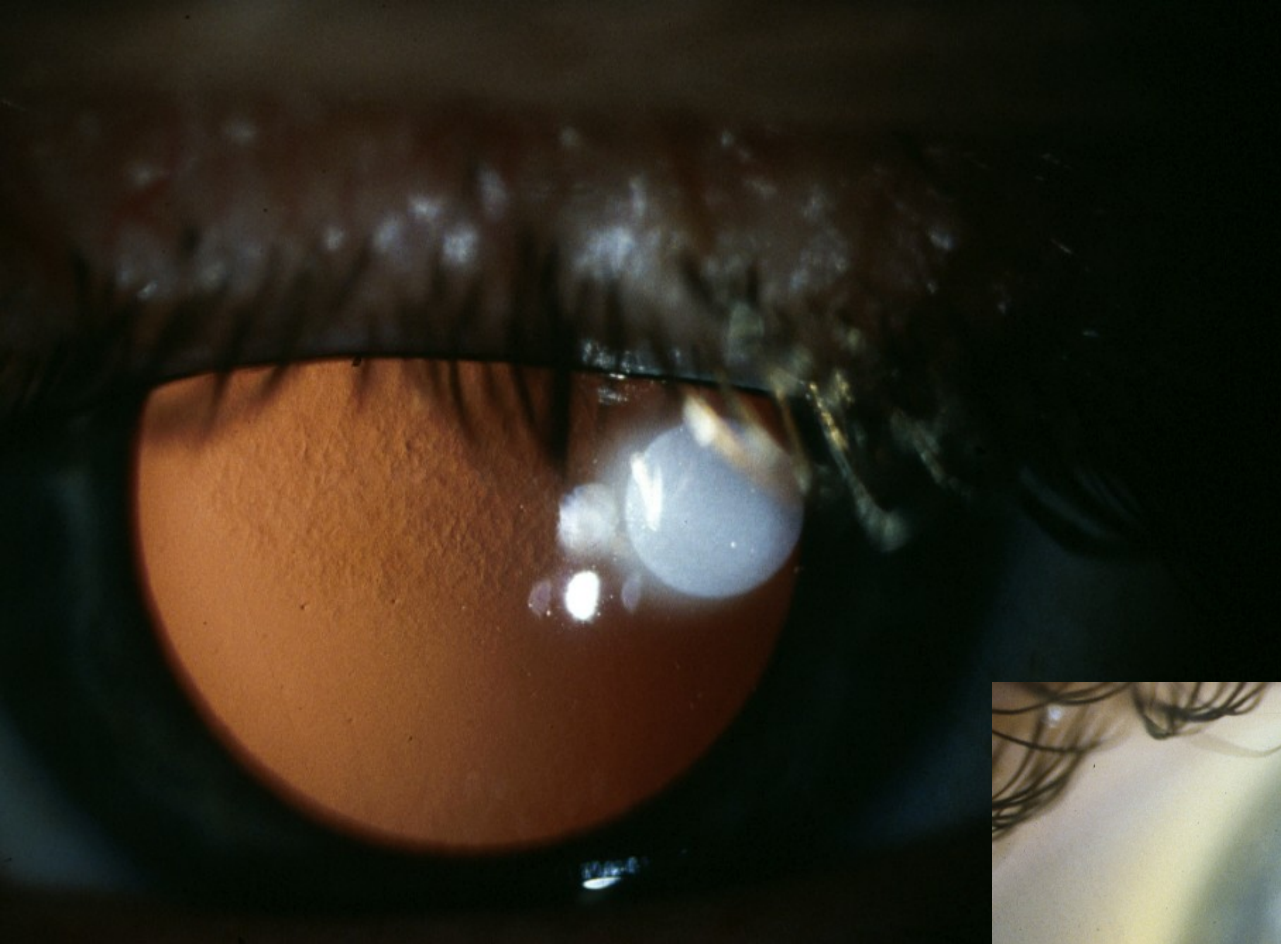
Haze 3.0+

Moderate 3.0+  
Diffuse pattern  
Confluence



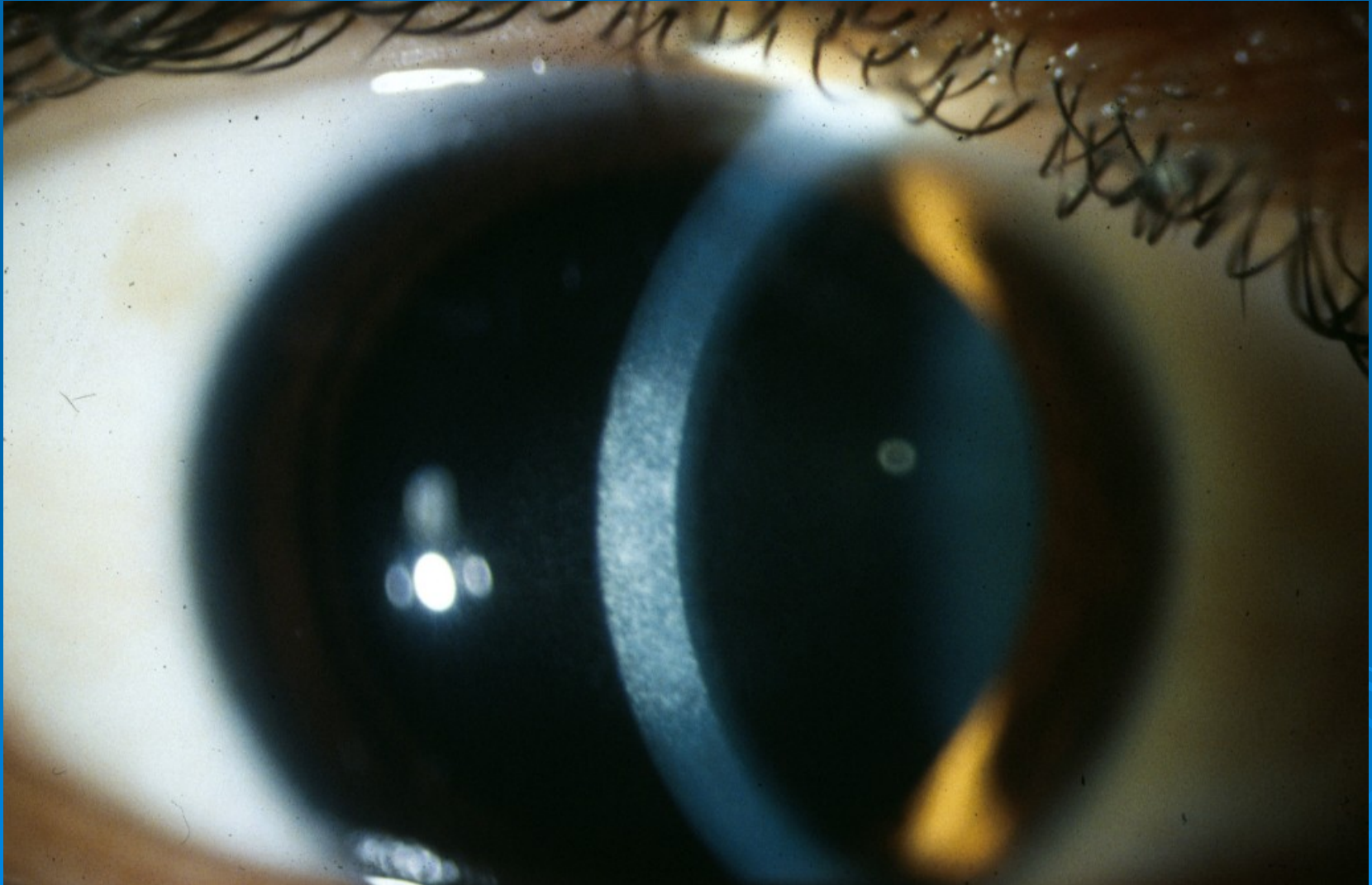


Haze 3.0+





# Haze 3.0+





Haze 4.0+

Severe 4.0+  
Confluent Haze  
Iris visible





# Haze 5.0+



Severe 5.0+  
Opaque cornea  
Diffuse collagen plaque

# Complications: Manage or Refer?

## Haze Treatment

### ➤ Early Onset Haze

- Ensure patient following prescribed steroid taper
- Observation

***MOST EARLY HAZE RESOLVES WITH  
TIME***

# Complications: Manage or Refer?

## Haze Treatment

### ➤ Late Onset Haze

- Observation
- Topical steroids
  - Aggressive dosing: Pred Forte 1% q2hr x 1-2 week, taper slowly q1-3 weeks, hang on to last drop (QAM) long (2-8 weeks), monitor IOP
- Return to Surgeon - PTK and/or Mitomycin C

# Complications: Manage or Refer?

## ➤ Loss of BCVA

- Usually early
- Uncommon late
- Causes
  - Epithelial irregularity
  - Irregular astigmatism
  - Decentered ablation
  - Central islands
  - Haze
  - Non-PRK cause

## • Evaluation

- Full eye exam
  - R/O retinal pathology
- Topography
- HCL over-refraction
- PAM
- Treat underlying cause as needed

# Complications: Manage or Refer?

## ➤ Refractive

- Primary under-correction
- Over-correction
- Regression



# Complications: Manage or Refer?

## ➤ Under-correction

- >1 D deviation from intended correction at 3-6 mos post-op
- Compare cycloplegic refractions
- Haze increases refractive myopia and refractive uncertainty

## • Causes

- Under-treatment
- Wet cornea
- Aggressive healer
- Rapid steroid taper
- Haze

# Complications: Manage or Refer?

## ➤ Under-correction

- Treatment

- Some myopia is good for peri-presbyopes
- Consider retreatment
- Ensure refractive stability ( $\pm 0.5$  D over 3 refractions, one month apart)

# Complications: Manage or Refer?

## ➤ Over-correction

- Common early
- Expect about 0.50 to 1.00 diopter myopic shift in first 6 months
- Causes
  - Poor pre-op cycloplegic refraction
  - Incorrect treatment parameters
  - Dry cornea during treatment
  - Thin epithelium post-op

# Complications: Manage or Refer?

## ➤ Over-correction

- Treatment

- If persists after 1 month, hasten steroid taper, monitor closely for haze
- Lubricants
- Soft Contact Lens
- Epithelial debridement
- Hyperopic PRK when stable

# Complications: Manage or Refer?

## ➤ Presbyopia

*“I didn’t realize that I wouldn’t be able to read the can labels at the grocery store”*

NO MATTER HOW MANY TIMES PRE-PRESBYOPES ARE TOLD ABOUT THE POTENTIAL FOR READING GLASSES POST-OP, MANY DO NOT (OR CHOOSE NOT TO) HEAR OR UNDERSTAND

## ➤ Emphasize, describe, and document preoperatively

# Complications: Manage or Refer?

## ➤ Regression

- > 1 Diopter deviation from intended correction at > 6 mos post-op
- May be associated with haze
- Risk factors
  - UV exposure
  - Rapid steroid taper
  - High myopia
  - Oral Contraceptives



# Complications: Manage or Refer?

## Regression Management @ 1 Month

### ➤ $< -1.00$ D

- Consider unplanned monovision
- True under correction than regression
- Increased steroid frequency and potency may reverse regression, but usually inadequate

### ➤ Plano

- Expect further regression of 0.50 to 1.00 D
- If emmetropia desired, continue FML QID for additional month, then taper gradually over 6 months total
- Prolonged low potency steroid may reduce regression to  $< -0.50$  D

# Complications: Manage or Refer?

## Regression Management @ 1 Month

### ➤ +1.00 D

- Ideal refraction at 1 month
- Continue standard regimen

### ➤ +1.50 D

- Ideal for young patient, likely will yield 20/20 uncorrected
- May yield slightly over correction in presbyopic patient

### ➤ +1.50 D cont'd

- Taper to FML TID, recheck in 2 weeks
  - If no regression, reduce and recheck dose every 2 weeks
  - If regression noted, continue standard regimen – longer healing pattern, full regression may take 6-9 months

# Complications: Manage or

## Refer? Regression Management @ 1 Month

### ➤ +2.00 D

- Reduce steroid to BID, recheck in 2 weeks
- If still  $> +1.50D$ , reduce to QAM and reassess in 2 weeks
- @ 2months
  - If  $> +1.50D$ , D/C steroid
  - If  $> +1.00D$ , continue QAM
- Once  $< +1.00$ , steroid QAM

If rate of regression or haze increase, increase steroids to BID

- Monitor at least bi-weekly during the 4 month healing phase
- Re-institute steroids when they reach  $+0.50$  to  $1.00D$  to fine tune regression toward plano (avert haze and further regression)

# Complications: Manage or Refer?

## Regression Management @ 1 Month

### ➤ > +2.00 D

- D/C steroids and monitor weekly
- Monitor rate of regression as well as refractive error at each visit
- Re-institute steroids to prevent rapid regression and haze
- When reaches +1.00 D
  - Rapid rate of regression (2-4 weeks)
    - Resume steroid BID
  - Slow rate of regression (4-12 weeks)
    - Resume steroid QAM
  - Taper slowly over months until stable

# Complications: Manage or Refer?

- Over-Response/Under-Response/Regression
  - Spectacle/CL wear
  - CLAPIKS – Contact Lens Assisted Pharmacologically Induced Kerato-Steepening

# Complications: Manage or Refer?

## ➤ Over-Response/Under-Response/Regression

- Hyperopic amelioration
  - CLAPIKS – Contact Lens Assisted Pharmacologically Induced Kerato-Steepening
  - Effective for low plus results, up to +1.50
  - Rx Acular QID with a tight contact lens worn extended wear
  - EW CL creates inflammation/stress, along with the NSAID countering the inflammation and locking in the collagen fibrils under stress yields a steepening effect shifting toward myopia, or less plus.



# Complications: Manage or Refer?

## ➤ Over-Response/Under-Response/Regression

- Retreatment
  - Only when refraction stable (within  $\pm 0.5$  D over 3 refractions, one month apart)
  - Typically >6-[9-12]-15 months post-op PRK
  - Typically 3-6 months post-op LASIK

# Complications: Manage or Refer?

## ➤ Miscellaneous

- Pregnancy-Induced Regression
  - Issues
    - Unreliable refractions
    - Altered wound healing - HAZE
    - Hormonal-based
    - Dry eyes
    - Medication toxicity, iatrogenic

# Complications: Manage or Refer?

## ➤ LASIK

- Day 1 & 4 - Striae, UCVA, Flap abrasion
- Week 1 - Striae, UCVA, Rx, BCVA, Ingrowth, Dryness
- Month 1 - Ingrowth, UCVA, Regression, Dryness
- Month 3 - Ingrowth, UCVA, Regression
- Month 6 - Confirm outcome and stability
- Month 12 - DFE for final visit

# Complications: Manage or Refer?

- Reassure! Reassure! Reassure!
  - “Your vision will continue to improve. You are not finished healing.”
  - “Try to be patient. I know it’s hard!”
  - “You’re right where you should be. This is a normal healing process.”

# Complications: Manage or Refer?

- If you have BCVA loss within Week 1, do not assume it will get better!
- You MUST rule out:
  - DIFFUSE LAMELLAR KERATITIS
  - FLAP STRIAE
  - CENTRAL ISLAND
  - DRYNESS



# Complications: Manage or Refer?

## ➤ “Sands of Sahara”

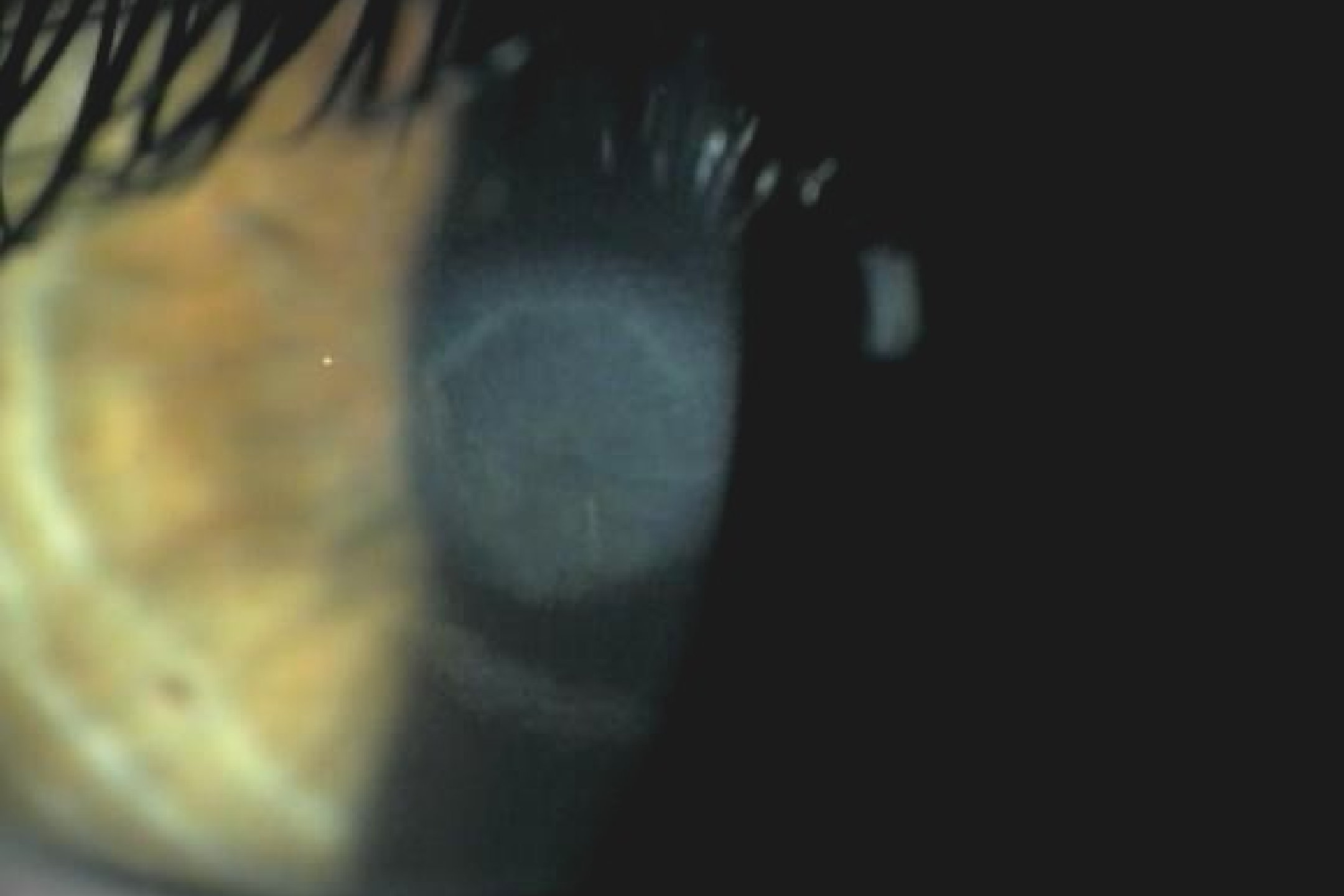
- Sands... - due to the “sifted sands” appearance at its most classical presentation
- Appears powdery, talc-like, grainy
- In the flap interface, no staining
- Subtle or significant
- Can cause rapid loss of BCVA

## ➤ Treatment

- Immediate/aggressive treatment
- 1% Pred Forte
  - Q1h first day or so, stabilize VA
  - decr to Q2h until VA improves to within one line of pre-op BCVA
  - decr to Q4h/QID as final resolves over the next 3-4 weeks

## ➤ Check IOP

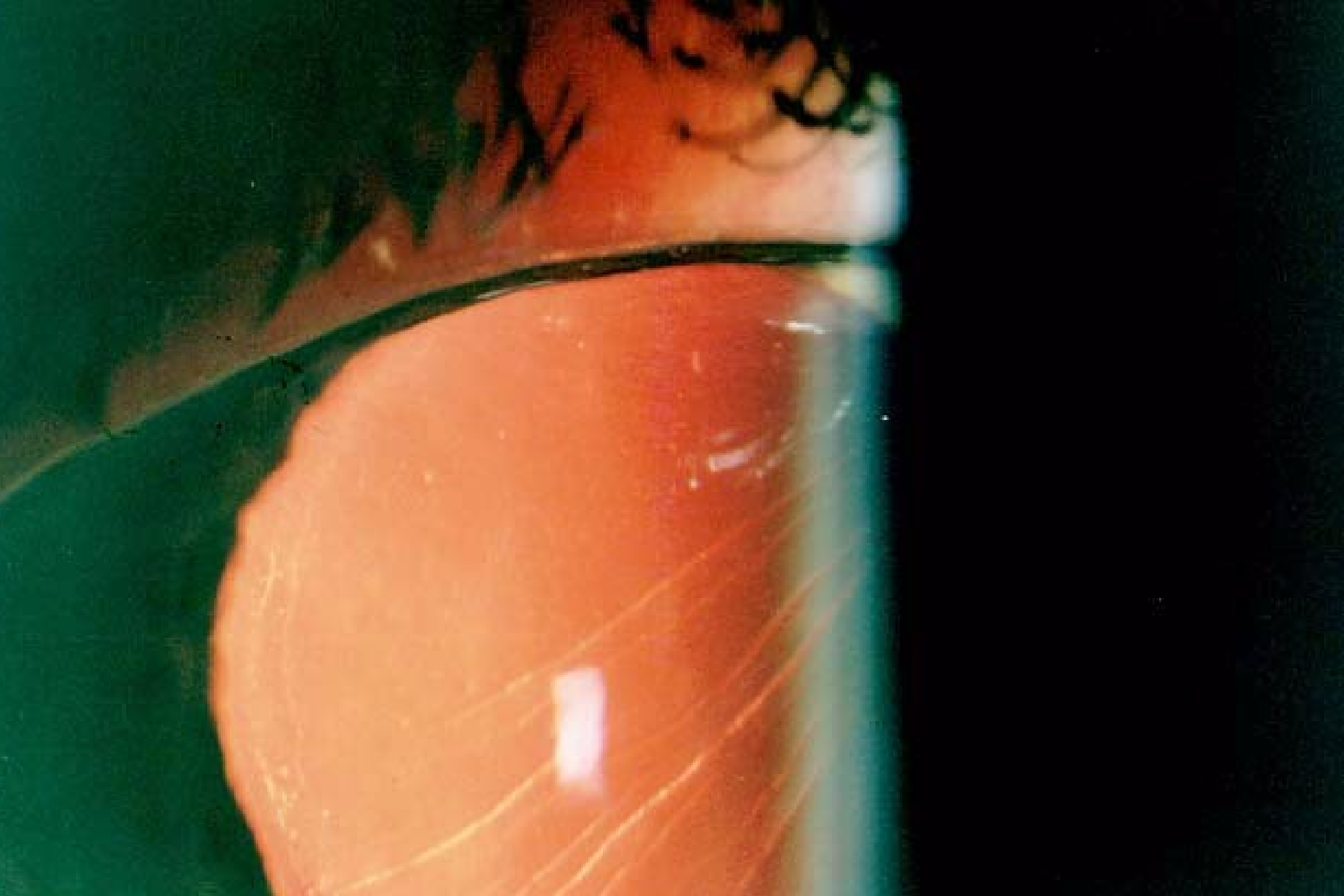




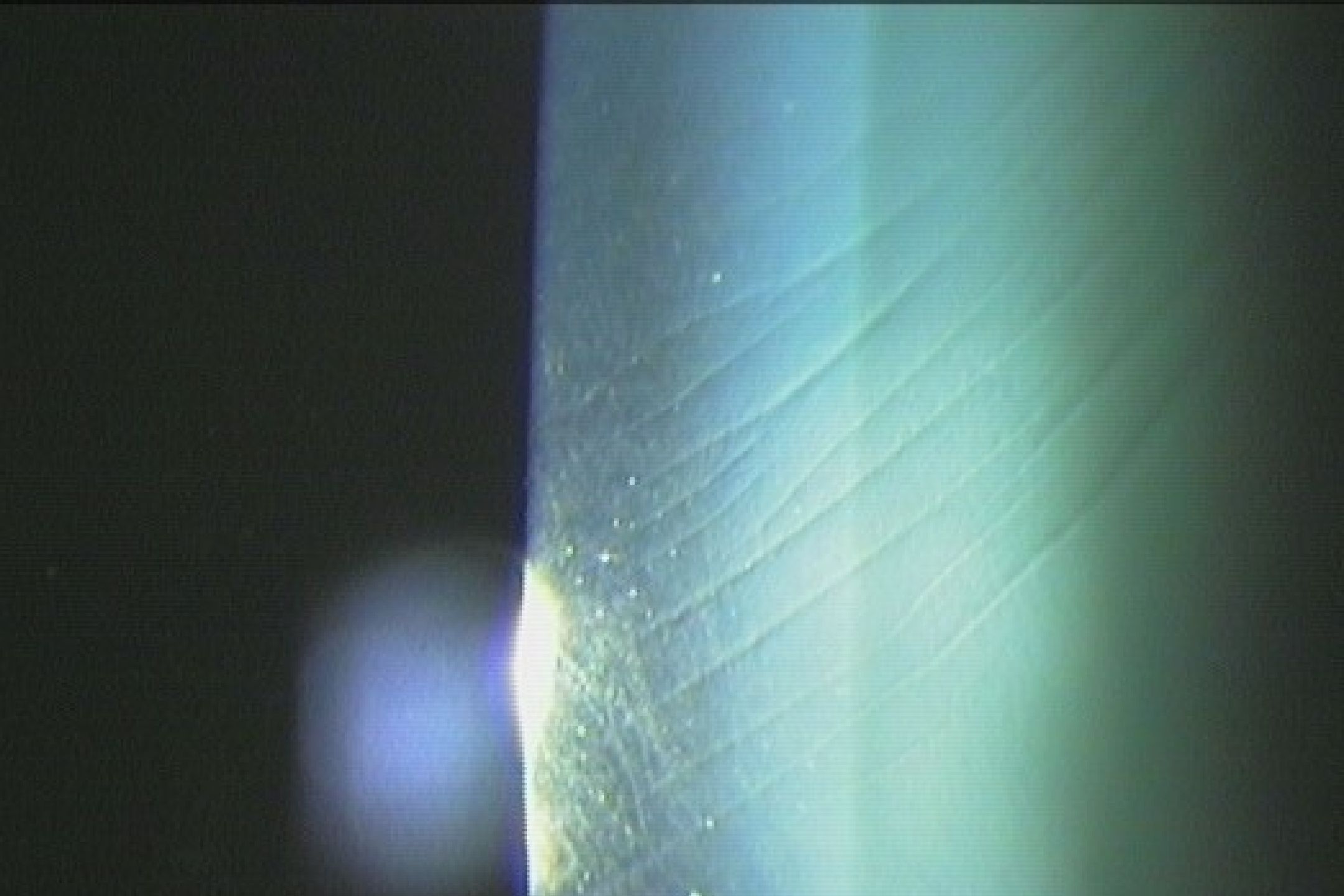
# Complications: Manage or Refer?

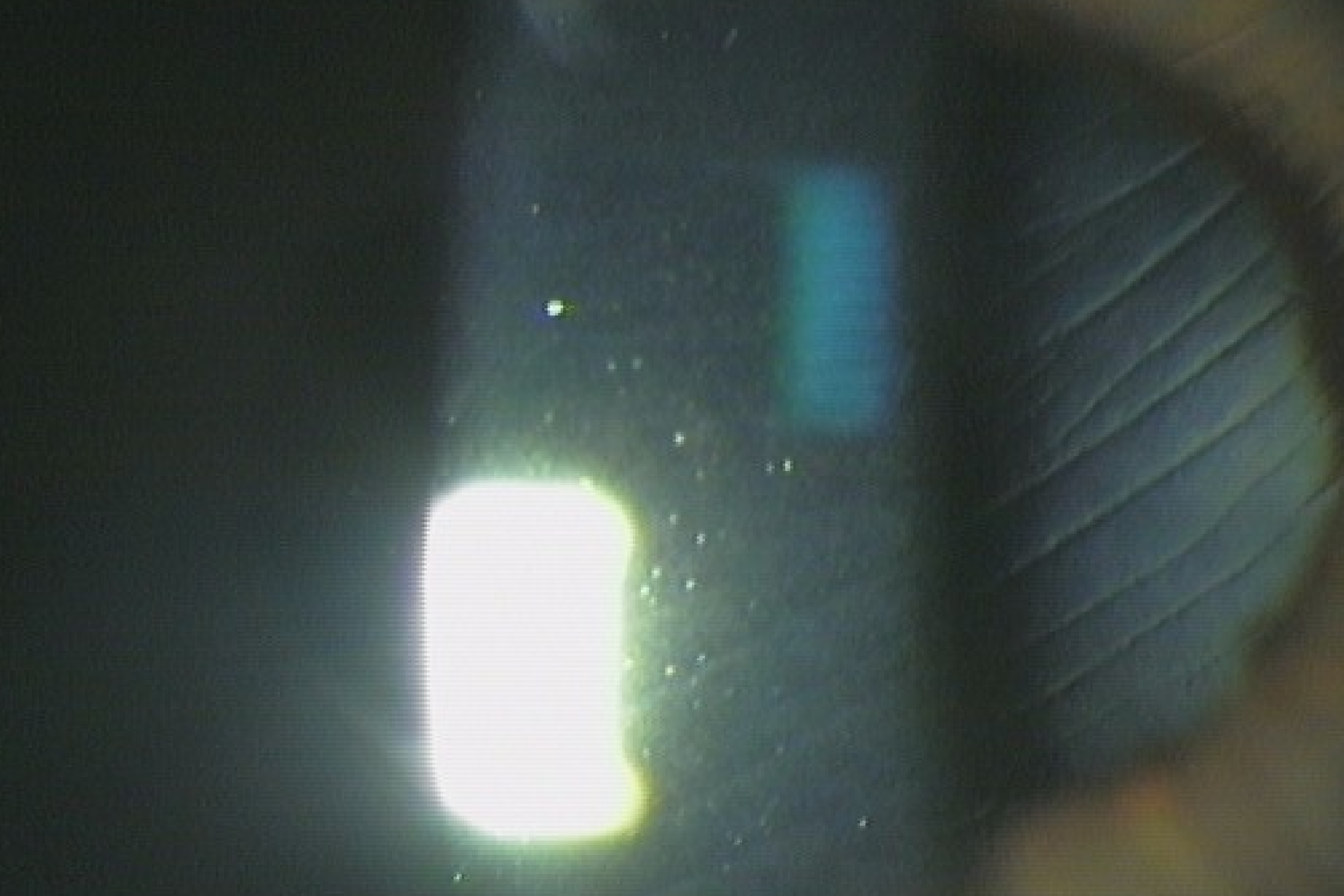
## ➤ Flap Striae or Wrinkles

- Can cause loss of BCVA
- Can cause irregular astigmatism
- Most effectively removed within 24 hours to 1 week
- Best seen on retro-illumination of dilated pupil, or with NaFl pooling in the “groove”

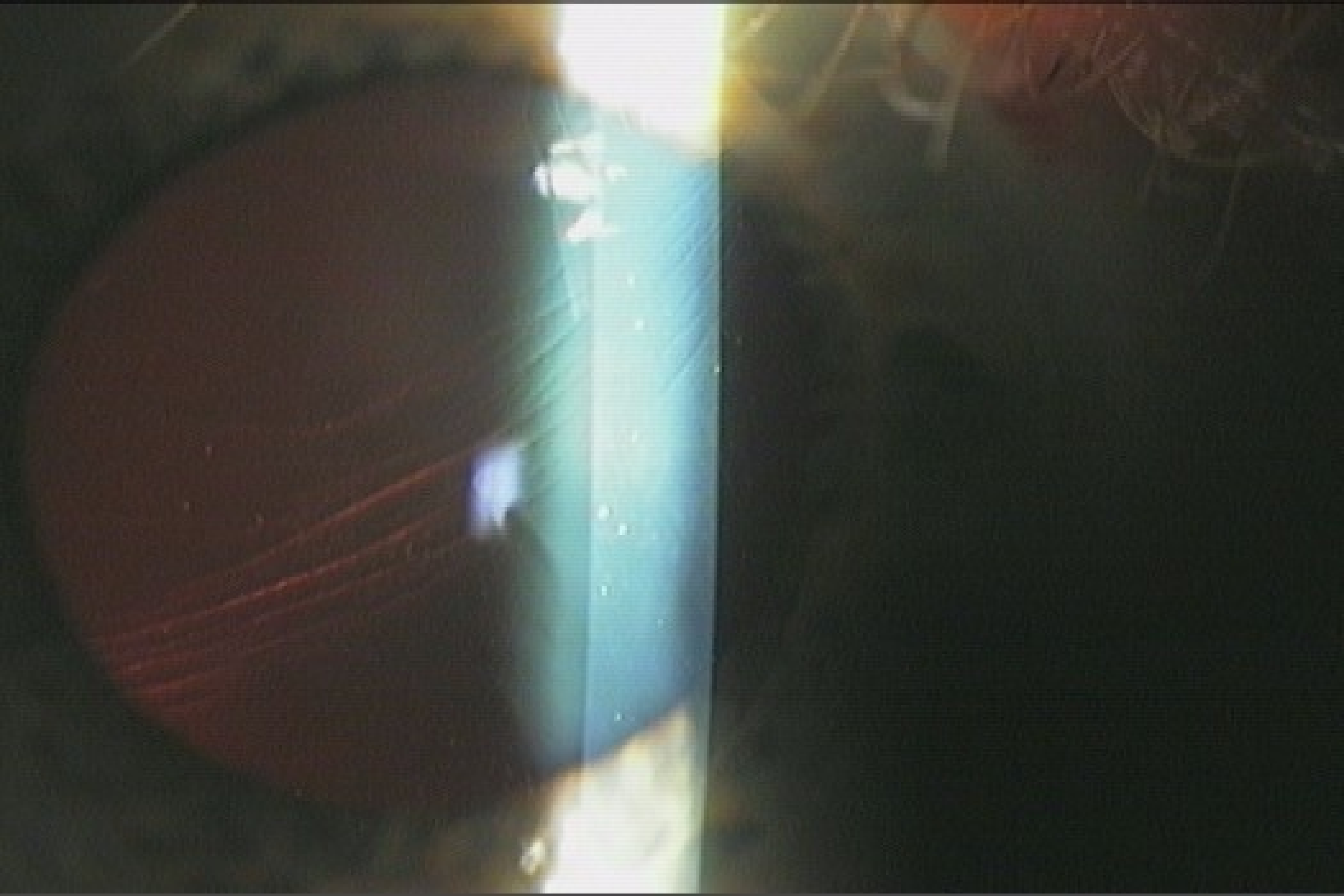












# Complications: Manage or Refer?

## ➤ Epithelial Ingrowth

- Can cause flap erosion and stromal melt!
- If present, monitor every 1-2 weeks
- Measure with slit lamp reticule
- Higher risk with flap abrasion





**Grade 1 Epithelial Ingrowth**



**Grade 2 Epithelial Ingrowth**

A microscopic image of tissue, likely a histological section, showing a dark, dense area on the left and a lighter, more fibrous area on the right. The boundary between the two areas is irregular and shows signs of cellular infiltration or ingrowth.

**Grade 3 Epithelial Ingrowth**



**Grade 4 Epithelial Ingrowth**

# Complications: Manage or Refer?

## ➤ Debris Down Under

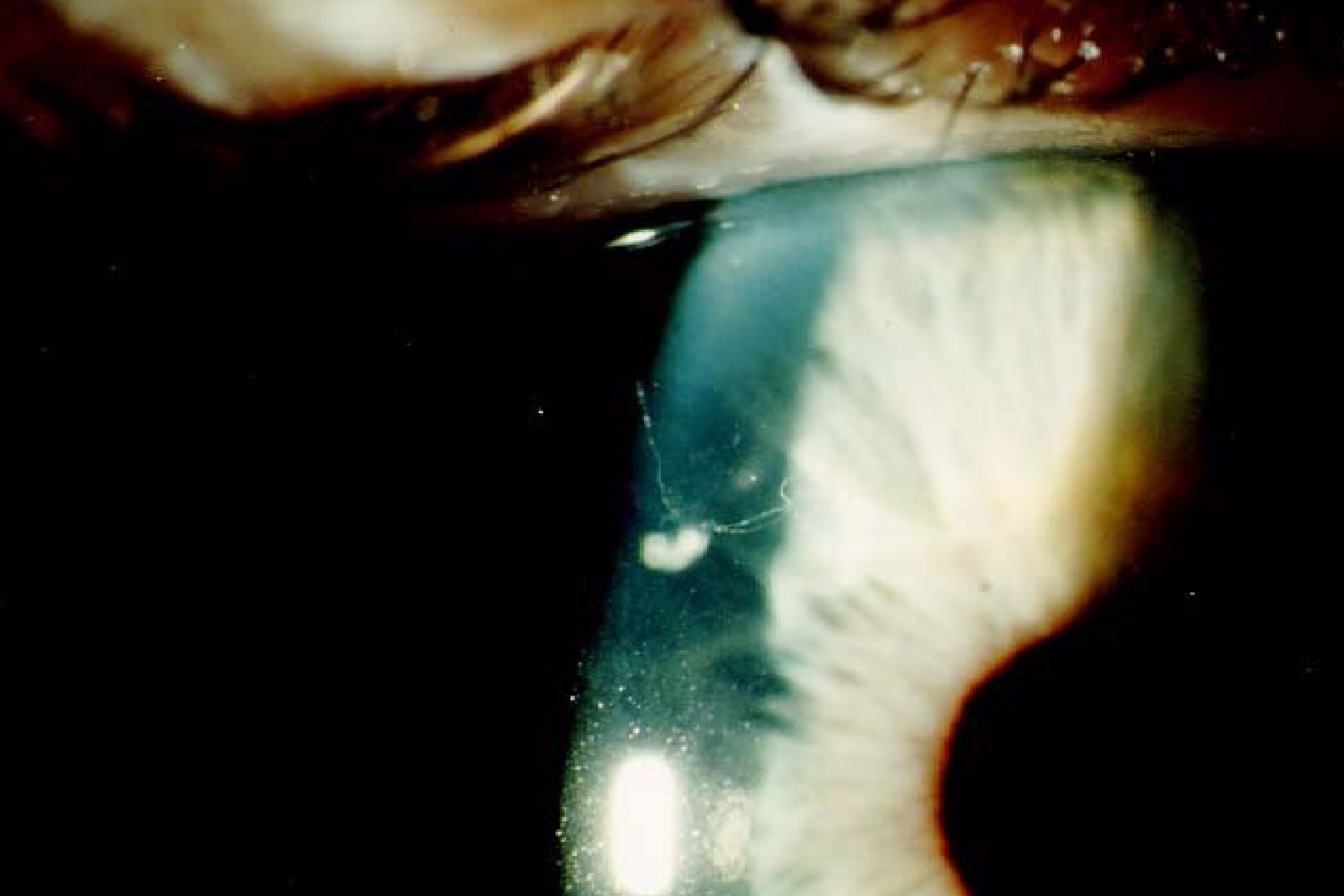
- No big deal...doesn't cause a problem
- May develop spots of infiltrate around them... don't worry
- Consider it a "souvenir"
- Usually lint, sebaceous secretions, etc.



**Extruding fibers must be removed...they  
act as a “wick” for bacteria**

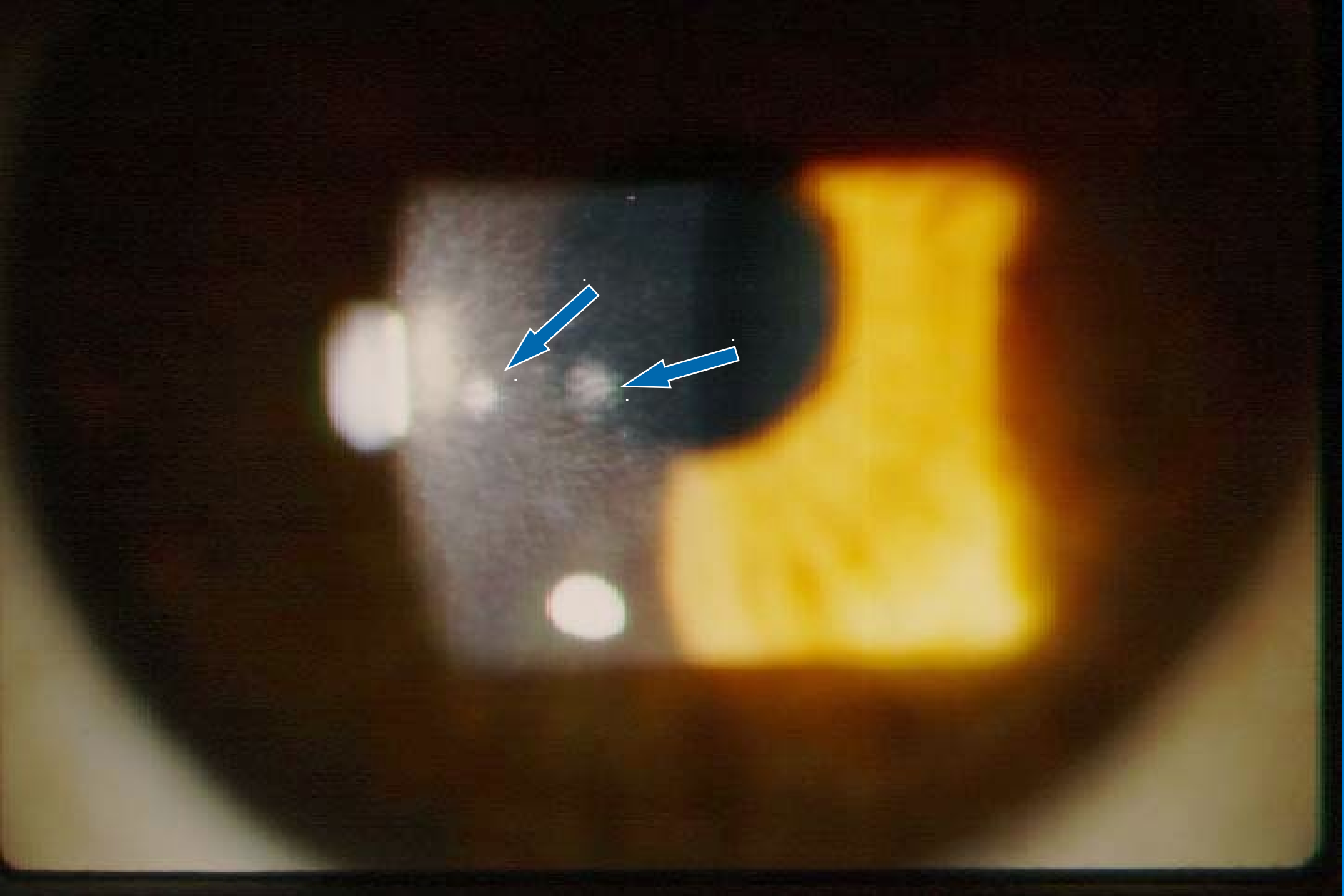




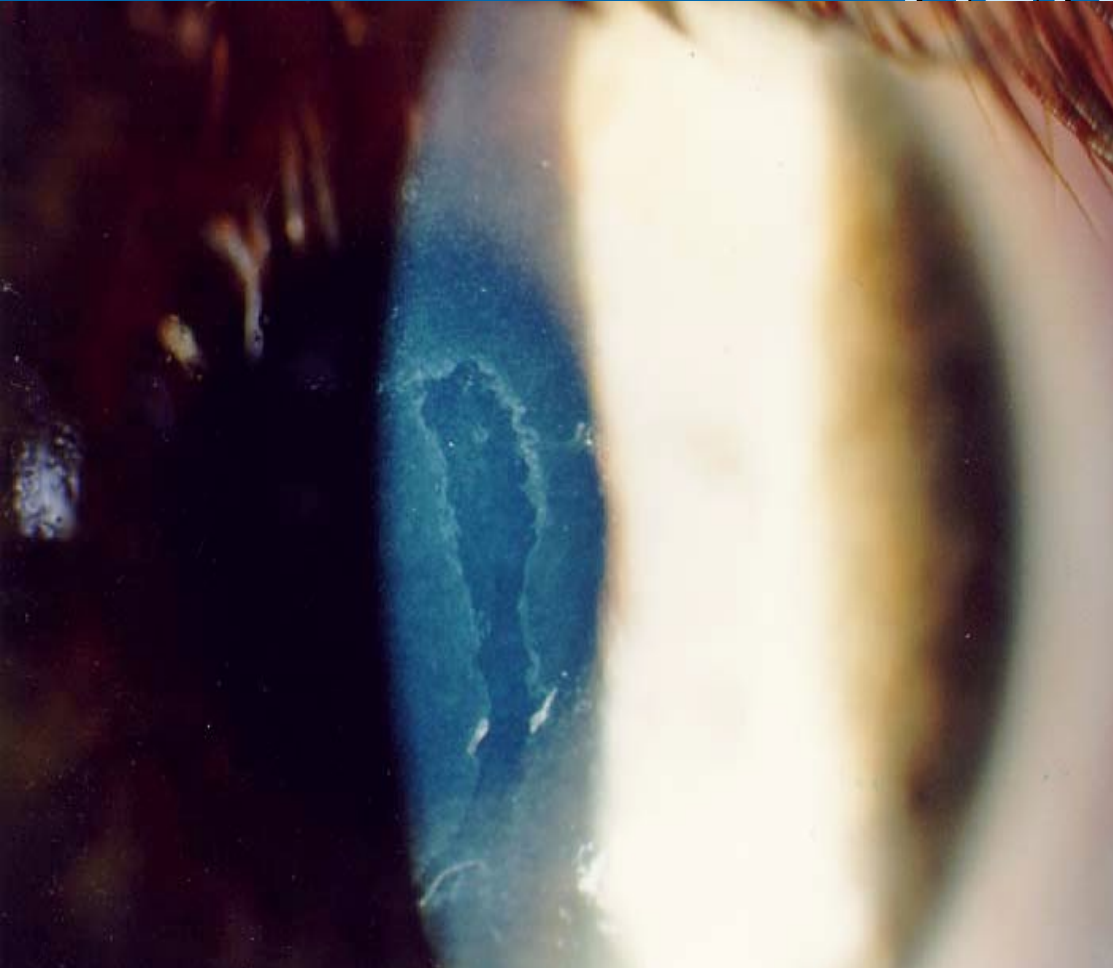


# Infiltrates Around Debris





# Complications: Manage or Refer?



## ➤ Flap Abrasions

- Do NOT patch or use ointment!
- Watch for ingrowth in the region
- Voltaren helps
- Bandage CL if flap intact